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Before The
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC

Federal Communications Commission
Office of the Secretary

In the matter of:

LORAL QUALCOMM SATELLITE
SERVICES, INC.

Request for a Pioneer's
Preference with regard to
Its Application for Authority
To Construct GLOBALSTAR, a
Low-Earth Orbit Satellite
Communications System

File No. _____

REQUEST FOR PIONEER'S PREFERENCE

Submitted by:

Linda K. Smith, Esq.
Robert M. Halperin, Esq.
William D. Wallace, Esq.
CROWELL & MORING
1001 Pennsylvania Avenue, N.W.
Washington, DC 20004
(202) 624-2500

Leslie A. Taylor, Esq.
LESLIE TAYLOR ASSOCIATES
6800 Carlynn Court
Bethesda, MD 20817
(202) 229-9341

Attorneys for Loral Qualcomm
Satellite Services, Inc.

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SUMMARY

Loral Qualcomm Satellite Services, Inc. (LQSS) seeks a pioneer's preference with respect its application for authority to construct GLOBALSTAR, an innovative, low-earth orbit (LEO) satellite communications system, which will provide new and enhanced services, including radiodetermination and mobile voice and data communications, utilizing the Radiodetermination Satellite Service (RDSS) bands.

The Commission's pioneer's preference is designed to encourage innovative communications research and technology such as that which is incorporated into the GLOBALSTAR application. GLOBALSTAR's innovative design is the product of LQSS's shareholders, Loral Aerospace Corporation and QUALCOMM, Inc., which have contributed their expertise to the proposal, particularly, in the areas of satellite systems and digital communications systems, respectively.

GLOBALSTAR's innovations in the areas of call set-up mechanisms, user validation and "soft" call hand-offs allow users to make local telephone calls without incurring long-distance charges and to maintain communications that are transparent to the transfer of the communication from one satellite to another. GLOBALSTAR also employs a number of innovative satellite and system design features, including its proposed constellation of eight satellites per orbital plane, circular orbits at 1389 km altitude, coverage cell formation through spot beams, call hand-off protocols, use of pilot channels, and multi-frequency, multi-beam antennas.

Innovative spread spectrum code division multiple access (CDMA) technology allows reuse of spectrum and compression of signals to enable GLOBALSTAR to use spectrum efficiently and effectively. CDMA provides to GLOBALSTAR the capability to concentrate signals in single beams to increase capacity in specific geographic areas for emergency situations, to optimize elevation angles for users, thus optimizing call hand-offs, and to avoid blockage by selecting the best signal path.

The use of innovative technologies and system architecture enable GLOBALSTAR to provide service to thousands of mobile voice and data users simultaneously. The theoretical capacity of GLOBALSTAR for RDSS is over 17 million locations/hours.

The research and technical advances incorporated into GLOBALSTAR would provide significant public service benefits. LQSS should be awarded a pioneer's preference because the GLOBALSTAR system fulfills the Commission's desire to encourage innovative communications technology and spectrum usage providing better communications service to the public.

GLOBALSTAR will allow the public access to RDSS, the benefits of which have long been recognized by the Commission. Moreover, GLOBALSTAR will provide low-cost and reliable mobile voice and data services nationwide, including rural areas where cellular telephone services may not be feasible. Furthermore, the GLOBALSTAR system is compatible with other LEO satellite, communications systems; therefore, LQSS could be awarded a pioneer's preference without deterring other applicants developing other innovative communications systems.

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REQUEST FOR PIONEER'S PREFERENCE

Pursuant to Section 1.402 of the Commission's Rules and the Commission's Report and Order establishing procedures to award pioneer's preferences, 6 FCC Rcd 3488 (1991), Loral Qualcomm Satellite Services, Inc. (LQSS),^{2/} by its attorneys, hereby submits this Request for Pioneer's Preference. LQSS seeks a preference with respect to GLOBALSTAR, an innovative, low-earth orbit (LEO) satellite communications system, which will provide new and enhanced services, including radiodetermination and mobile

^{1/} At the time of filing its GLOBALSTAR application, the Applicant was known as "Loral Cellular Systems, Corp." The change in the name of the Applicant was reported to the Commission in an amendment filed October 11, 1991.

^{2/} The Applicant requested a pioneer's preference in the GLOBALSTAR application (pages 6-8). This petition supplements that request.

voice and data communications, utilizing the Radiodetermination Satellite Service (RDSS) bands.^{3/}

I. THE COMMISSION ESTABLISHED THE PIONEER'S PREFERENCE TO FOSTER DEVELOPMENT OF INNOVATIVE COMMUNICATIONS SYSTEMS LIKE GLOBALSTAR WHICH WILL PROVIDE BETTER SERVICE TO THE PUBLIC.

Recently, the Commission established a "pioneer's preference" for applicants proposing new radio services and/or new technologies enhancing existing services. The purpose of this preference is to encourage the development of innovative communications technology and spectrum usage. Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 FCC Rcd 3488 (1991). In this Report and Order, the Commission outlined three requirements for obtaining the preference.

First, the applicant must request a pioneer's preference for a proposal to introduce a new radio service, or to improve an existing service through new technology which significantly improves spectrum efficiency or enables sharing or co-use of allocated spectrum. 6 FCC Rcd at 3492, ¶ 37.

Second, to effectuate the proposal, the applicant must file a rulemaking petition requesting either that spectrum be allocated

^{3/} The application was accepted for filing on October 24, 1991 (DA 91-1308). Pursuant to Section 1.401 of the Commission's Rules, the Petitioner is filing concurrently with this request a Petition for Rulemaking, seeking amendment of Parts 2 and 25 of the Commission's Rules to facilitate operation of low earth orbit satellite systems providing radiodetermination, mobile voice and data services in the RDSS spectrum.

for a new service or that the rules be amended to accommodate new technology. Id.

Third, the applicant must establish, through experimentation or other means, that the proposal is technically feasible. Id. at 3493, ¶ 39.

In determining whether to award a preference, the Commission stated that it will apply a flexible standard. The applicant must show that it "has developed an innovative proposal that leads to the establishment of a service not currently provided or a substantial enhancement of an existing service, provided, that the rules adopted for the new or existing service are a reasonable outgrowth of the proposal and lend themselves to the grant of a preference and a license to the pioneer." Id. at 3494, ¶ 47.

In its determination, the Commission will be guided by the objective of the pioneer's preference: "to reduce the risk and uncertainty innovating parties face in [the Commission's] existing rule making and licensing procedures, and therefore to encourage the development of new services and new technologies." Id. at 3492, at ¶ 32. In this way, the public interest will be served by fostering valuable new technologies and services. See id. at 3490, ¶ 18.

II. THE APPLICANT IS ENTITLED TO AN AWARD OF A PIONEER'S PREFERENCE FOR THE DEVELOPMENT OF GLOBALSTAR.

On June 3, 1991, LQSS filed an application for authority to construct GLOBALSTAR, a 48-satellite communications system which would be used to provide radiodetermination, mobile voice and data services from low-earth orbit. The system is designed to utilize

existing terrestrial telecommunications infrastructures. It will thus complement existing telecommunications service providers. Furthermore, GLOBALSTAR is compatible with other LEO communications systems, and, therefore, is consistent with the Commission's policies encouraging open entry and competition in the satellite services. See, e.g., Radiodetermination Satellite Service, 60 RR 2d 298, 301 (1986).

The GLOBALSTAR system will provide both a new service and enhance existing spectrum usage through a number of innovative developments in the areas of satellite communications and spectrum usage. Accordingly, for the reasons discussed below, LQSS is entitled to an award of a pioneer's preference.

A. GLOBALSTAR Will Provide a New Service and Enhance Existing Spectrum Usage.

The Commission, in order to promote the development of new communications services to the public, created the Radiodetermination Satellite Service for the provision, on a primary basis, of radiolocation and navigation services. See Radiodetermination Satellite Service, 58 RR 2d 1416 (1985), on recon., 60 RR 2d 245 (1986). This domestic allocation provided the basis for adoption, on a worldwide basis, of a spectrum allocation for RDSS at the 1987 World Administrative Radio Conference. This allocation is separate from that for mobile satellite services (MSS). See Mobile Satellite Service, 2 FCC Rcd 1825 (1986), on recon., 2 FCC Rcd 6830 (1987) (subsequent history omitted).

LQSS proposes to use the spectrum currently allocated to RDSS for new and innovative services, including the delivery of RDSS,

data and voice to handheld and other mobile or portable transceivers. These services would be provided throughout the United States, and, eventually, throughout the world.

LQSS thus will provide a new service, as well as RDSS, through innovative technology permitting use of spectrum which could previously only accommodate RDSS. The concomitant improvement in spectrum efficiency not only will bring valuable RDSS service to the public, but also will make available new, high quality and economical mobile voice systems to meet the public demand for such services.

B. The Applicant Has Sought Amendments to
The Commission's Rules To Accommodate
GLOBALSTAR's Proposed Spectrum Usage.

In its Petition for Rulemaking filed concurrently with this Request, LQSS has sought amendments to the Commission's Rules to accommodate two proposed alternative and unique frequency plans for the GLOBALSTAR system:^{4/}

	<u>System A</u>	<u>System B</u>
Satellite-to-user	1610.0-1626.5 MHz	2483.5-2500.0 MHz
User-to-satellite	1610.0-1626.5 MHz	1610.0-1626.5 MHz
Satellite-to-gateway	5199.5-5216.0 MHz	5158.5-5216.0 MHz
Gateway-to-satellite	6525.0-6541.5 MHz	6484.0-6541.5 MHz

In order to accommodate this spectrum usage plan, LQSS proposes the following amendments to the Commission's Rules:

(1) Sections 2.106 and 25.141(d) (formerly 25.392(d)) of the Commission's Rules would be amended to allow satellite system

^{4/} LQSS has requested waivers of the Commission's Rules in the GLOBALSTAR application to accommodate its proposed frequency plans. GLOBALSTAR Application, at 8-14.

operators to provide mobile voice, data and RDSS services in the bands currently allocated to RDSS.

(2) For System A, an amendment to the allocations in Section 25.202(a)(2) is proposed which would allow use of the L-band 1610.0-1626.5 MHz for downlinks as well as uplinks.

(3) For System B, an amendment would provide additional bandwidth in the RDSS feeder links and to exceed in the S-band 2483.5-2500.0 MHz the power flux density limit of:

$-154 + 0.5 (x-5) \text{ db(W/m}^2\text{)}$ in any 4 kHz band for angles of arrival X (in degrees) between 5 and 25 degrees above the horizontal plane.^{5/}

These limits relate to the power flux density which would be obtained under assumed free-space propagation conditions.

Relaxation of these limits by approximately 10 dB for the S-band is necessary to allow the innovative spectrum use to provide optimal frequency utilization.

These requested amendments are directly tied to the spectrum needed to operate GLOBALSTAR, and, therefore, are a "logical outgrowth" of the proposal. The rule changes also will improve an authorized service, and enhance the opportunities to share and co-use allocated spectrum.

^{5/} See RR 2557 in Appendix 28 of the Radio Regulations.

C. The Applicant Has Established Technical Feasibility in the GLOBALSTAR Application.

An extensive description of the operation of the GLOBALSTAR system was provided in the application filed on June 3, 1991. See GLOBALSTAR Application, Part II & Appendix 5. Also included in the application is an interference study, demonstrating the compatibility of GLOBALSTAR with authorized satellite services, such as GEOSTAR and GLONASS, the radio astronomy service, and other proposed RDSS/MSS systems such as Iridium. See GLOBALSTAR Application, Appendix 6.

LQSS is continuing to enhance the full potential of the GLOBALSTAR CDMA technology and other technologies to be used in the GLOBALSTAR system.

D. GLOBALSTAR Will Serve a Nationwide Market for RDSS and Mobile Voice Communications.

In the Report and Order, the Commission stated that it would award a pioneer's preference within a specific area of license appropriate to the proposal for spectrum usage. 6 FCC Rcd 3494, ¶ 53. "Where a service is inherently nationwide, we will consider granting a nationwide preference." Id. at 3495, ¶ 54.

As described fully in the GLOBALSTAR application, the service area of the system is inherently nationwide, indeed, global. Accordingly, LQSS requests that it be awarded a pioneer's preference for the entire United States, including CONUS, Hawaii, Alaska, Puerto Rico and the Virgin Islands.

III. THE GLOBALSTAR SYSTEM IS THE PRODUCT OF INNOVATIVE COMMUNICATIONS RESEARCH AND DEVELOPMENT WHICH THE PIONEER'S PREFERENCE IS DESIGNED TO FOSTER.

As the Commission recognized in the Report and Order establishing the pioneer's preference, deciding whether and to whom to award a pioneer's preference depends upon the objective of providing "incentive to innovators to either bring forth new services or to increase the efficiency of existing services." 6 FCC Rcd at 3495, ¶ 57. The Commission is aware that once technology has become publicly available, there may be many applicants who propose a new communications service, seek amendments to the Commission's Rules to accommodate it, and provide documentation that the proposal is technically feasible. Id. However, for the pioneer's preference to serve its purpose of fostering new technology, it must be awarded to the entity or entities whose technical innovations made the new service possible.

A number of entities (e.g., Constellation Communications, Inc., TRW, Ellipsat Corporation, and Motorola Satellite Communications, Inc.) have filed applications with the Commission proposing LEO satellite communications systems providing combinations of RDSS and MSS service, and are seeking pioneer's preferences. However, LQSS submits that it should receive a pioneer's preference for the innovative technology which makes GLOBALSTAR possible and results in a high capacity and spectrally efficient RDSS, voice and data LEO system.

A. GLOBALSTAR Is the Product of Innovative and Experienced Communications Services Providers.

The development of GLOBALSTAR has benefited from the expertise of the Applicant's shareholders: Loral Aerospace Corp. and QUALCOMM, Inc. Loral Aerospace is an internationally recognized leader in the development of intelligence communications, satellite systems and space operations, among other areas. QUALCOMM is a leading-edge digital communications services company specializing in the design, development, manufacture, service and support of advanced digital communications systems.^{6/} LQSS has developed an innovative, low-cost, spectrum efficient system which can be used to provide basic communications in remote areas and to enhance or extend networks in areas with well-developed communications services.

B. LORAL and QUALCOMM Have Developed Substantial New Technologies which will Be Used in the GLOBALSTAR System

LQSS's proposal to implement a low-earth orbit satellite system providing RDSS, mobile voice and data communications reflects substantial innovation in the areas of system architecture, satellite and system design, spread spectrum CDMA, and system capacity.

1. System Architecture. The system architecture of GLOBALSTAR utilizes many innovative and unique features which enable it to provide multiple user benefits, including interoperability with the existing PSTN. Some of the architecture features unique to GLOBALSTAR relate to: (1) call set-up

^{6/} QUALCOMM is the leading developer of CDMA for digital cellular telephone systems.

mechanisms; (2) user validation; and (3) "soft" call hand-offs. These features will enable the GLOBALSTAR user to make local telephone calls without incurring long-distance charges and to maintain communications that are transparent to the transfer of the communication from one satellite to another.

2. Satellite and System Design. Among the innovative design features utilized in the GLOBALSTAR system are:

- (1) constellation design of eight satellites per orbital plane;
- (2) circular orbits at 1389 km altitude;
- (3) spot beams on the satellites to form coverage cells with the major axis of the coverage cells aligned with the velocity vector of the satellite movement to increase the time a user is covered by the same satellite beam;
- (4) call hand-off protocols to ensure that call hand-offs are minimized and imperceptible to users;
- (5) use of the pilot channel to obtain synchronization with the gateway stations and as a coherent carrier phase reference for demodulation; and
- (6) innovative multi-frequency, multi-beam antennas.

In particular, the GLOBALSTAR antennas are designed to compensate for the difference in the satellite-to-user link losses between the "near" and the "far" users, so that the power flux density of the "far" users is about the same as that of the "near" users. This GLOBALSTAR antenna design will reduce the near-far problem experienced by many cellular-type systems, reduce harmful

interference into the systems and increase the capacity of the system.

Each satellite communicates with the mobile user via the satellite-to-user links and with gateway stations directly via the feeder links. The RDSS functions are performed at the gateway stations or at the user terminal, while voice/data communications are routed through the gateway stations. Each gateway station will communicate with multiple satellites simultaneously. The gateway stations also handle the interface between the GLOBALSTAR network and the PSTN/PLMN systems.

Specific aspects of the GLOBALSTAR system are the subject of patents and/or applications for patents.

In summary, the GLOBALSTAR space segment utilizes numerous innovative technical advances, employs an innovative system architecture involving proprietary software components and will implement these features in a system providing new and important services to the public.

3. Spread Spectrum CDMA. QUALCOMM has invented and patented breakthrough code division multiple access ("CDMA") technology for a number of uses including cellular telephony. Innovative CDMA techniques for reuse of frequencies and compression of signals are incorporated in the GLOBALSTAR system to enable it to use spectrum efficiently and effectively.^{7/} Some of the capabilities of the GLOBALSTAR system made possible through

^{7/} A complete description of CDMA is provided in Appendix 5 of the GLOBALSTAR Application. This appendix also provides information on the role of QUALCOMM in developing and implementing CDMA technology.

the use of CDMA include: (1) the ability to concentrate signals in single beams to increase capacity in specific geographic areas to address variations in demand or emergency situations; (2) the ability to optimize the elevation angles for users (through use of CDMA to control timing of call hand-offs); and (3) the ability to avoid blockage by selecting the best signal path.

CDMA would be used for both frequency plans proposed in the alternative for the GLOBALSTAR system:

	<u>System A</u>	<u>System B</u>
Satellite-to-user	1610.0-1626.5 MHz	2483.5-2500.0 MHz
User-to-satellite	1610.0-1626.5 MHz	1610.0-1626.5 MHz
Satellite-to-gateway	5199.5-5216.0 MHz	5158.5-5216.0 MHz
Gateway-to-satellite	6525.0-6541.5 MHz	6484.0-6541.5 MHz

In System A, GLOBALSTAR will utilize the designated RDSS L-band spectrum for both satellite/user links, that is, for both the uplink and the downlink. System A also uses the RDSS C-band feeder link spectrum for GLOBALSTAR's gateway/satellite links.

With System A, GLOBALSTAR would employ time domain duplexing (TDD) -- frequency division -- code division multiple access (CDMA) with beam hopping to allow multiple access with minimal interference. The L-band spectrum would be divided into 13 sub-bands of 1.25 MHz bandwidth. Using synchronized CDMA techniques, CDMA sub-bands can be spaced relatively closely with minimum adjacent channel interference. The system would employ a 60 msec TDD frame with six 10 msec time slots, three for transmission and three for receiving. Within each time slot, the signals will either transmit or receive via two beams (beam hopping). TDD will minimize interference to and from other systems, while beam

hopping will reduce mutual interference to and from beams. This use of TDD, CDMA with beam hopping is unique to the GLOBALSTAR system.

With this approach, the L-band spectrum is reused two times for both uplink and downlink. The same spectrum is reused three times through beam hopping, and again for each of the 48 proposed satellites. Thus, System A allows highly efficient reuse of the L-band 288 times. The C-band feeder link spectrum is reused twice per satellite through dual polarization.

System B presents an alternative design which provides service employing the RDSS L-band for the user-to-satellite uplink and the RDSS S-band spectrum for the satellite-to-user downlink. In the L- and S-band spectrum, the 16.5 MHz bandwidths are subdivided into thirteen 1.25 MHz sub-bands. CDMA is again used to support multiple access. The L- and S-band frequencies are again reused 288 times through multiple beam antenna technology (six times) and multiple satellites (48 times).

To accommodate signals from the six spot beams, however, additional feeder link bandwidth would be used in System B. Consequently, System B requires use of the RDSS C-band frequencies allocated for RDSS feeder links as well as FSS spectrum 6484.0-6541.5 MHz for the feeder uplinks and 5158.5-5216.0 MHz for the feeder downlinks. The C-band spectrum for these feeder links will be reused through dual polarization.

System B does not employ beam hopping or TDD; however, it has the capability of accommodating other techniques without changing the satellite design.

4. System Capacity. The innovative technologies and system architecture enable GLOBALSTAR to provide service to thousands of voice and data users simultaneously.

The RDSS capacity for mobile users is virtually infinite. As long as an RDSS transceiver can receive GLOBALSTAR coverage, it can calculate its user's position. The RDSS tracking and location capacity of the GLOBALSTAR system is also very large. The RDSS protocol is actually part of the signalling overhead of the voice channel. Even if only 5 percent is assumed for the signalling overhead and each RDSS location requires 100 bit data exchange, then the theoretical RDSS capacity of the system is 17.28 million locations/hours. It should be noted that providing RDSS does not reduce GLOBALSTAR's communications capacity, as the RDSS function is derived from the signalling overhead of the communications channels.

C. GLOBALSTAR Is Compatible With Other LEO Systems.

The Commission has recognized that it may be appropriate to award pioneer's preferences to multiple applicants for similar new service proposals. Report and Order, 6 FCC Rcd at 3495, ¶ 57. In the event that the Commission decides that the applicants for LEO-systems providing RDSS/MSS services present such a situation, LQSS submits that it would be entitled to a preference for the development of its innovative system designs, utilizing interconnection with the PSTN and other terrestrial networks, its call hand-off protocols, and the key CDMA technology inventions and applications in GLOBALSTAR enabling extraordinary spectrum efficiency.

The GLOBALSTAR proposal is compatible with many existing and proposed communications services using the RDSS bands. See GLOBALSTAR Application, Appendix 6. Therefore, awarding a preference to LQSS in addition to any preferences awarded to other LEO applicants would accord with the Commission's objective of fostering innovation in communications technology. LQSS would be rewarded for its efforts in developing new and enhanced radio services, and other applicants would not be deterred from research and development which led to compatible communications systems.

IV. THE GLOBALSTAR PROPOSAL SATISFIES THE COMMISSION'S
TECHNICAL AND PUBLIC INTEREST STANDARDS FOR
AWARDING A PIONEER'S PREFERENCE.

As has been detailed more fully in the GLOBALSTAR Application (Sections I(3) & (11)), GLOBALSTAR serves the public interest by providing innovative telecommunications services which will fill currently unserved needs and enhance existing services. There are no currently operational RDSS-band service providers. GLOBALSTAR will provide RDSS throughout the United States, offering a significant new service which will benefit the public safety and health of all citizens through private and institutional uses.

The public demand for mobile voice and data services is increasing in both urban and rural markets. See GLOBALSTAR Application, Section I(3). GLOBALSTAR will provide high quality, low-cost and reliable mobile voice services nationwide and in rural areas where cellular telephone service may not be economically feasible. It also will enhance mobile services in urban areas where demand is likely to grow rapidly.

The reallocation of spectrum needed for GLOBALSTAR is reasonable particularly in light of the breadth of services which the system will offer. At present, the RDSS spectrum is fallow, providing no public interest benefits, and, it may be that a pure-RDSS service is not economically viable.^{8/} Using the Applicant's innovative LEO satellite technology, system architecture and spread spectrum CDMA techniques, the GLOBALSTAR system would make use of this spectrum, providing both RDSS and mobile voice services, on frequencies that previously could accommodate only radiodetermination service.

In its Petition for Rulemaking, the Applicant has sought amendments to the Commission's rules which would accommodate GLOBALSTAR. These proposed amendments are logical outgrowths of the innovative technology which makes possible GLOBALSTAR's RDSS, voice and data services. See Report and Order, 6 FCC Rcd at 3494, ¶ 47.

V. CONCLUSION.

For the reasons set forth above, LQSS requests that it be awarded a pioneer's preference for GLOBALSTAR which will provide a new radio service utilizing the RDSS bands, enhancing RDSS service with mobile voice and data communications through significant new


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The Commission has recognized this in its recommendations for the 1992 WARC Conference. An Inquiry Relating to Preparation for the International Telecommunication Union World Administrative Radio Conference, 6 FCC Rcd 3900, 3906 (1991). The Commission has proposed to license RDSS and MSS systems on a co-primary basis in the frequencies previously allocated to RDSS alone. The GLOBALSTAR spectrum usage plan is consistent with this recommendation.

technologies enabling a highly efficient use of the
electromagnetic spectrum.

Respectfully submitted,

LORAL QUALCOMM SATELLITE SERVICES, INC.

By: 
Linda K. Smith, Esq.
Robert M. Halperin, Esq.
William D. Wallace, Esq.
CROWELL & MORING
1001 Pennsylvania Avenue, N.W.
Washington, DC 20004
(202) 624-2500

Leslie A. Taylor, Esq.
LESLIE TAYLOR ASSOCIATES
6800 Carlynn Court
Bethesda, MD 20817
(202) 229-9341

Its Attorneys

November 4, 1991

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Loral Qualcomm Satellite Services, Inc.'s Request for Pioneer's Preference was served by first-class, U.S. mail, postage prepaid this 4th day of November, 1991 upon the following counsel of record:

Lon C. Levin, Esquire
Glenn S. Richards, Esquire
GURMAN, KURTIS, BLASK & FREEDMAN, CHTD.
1400 Sixteenth Street, N.W.
Suite 500
Washington, D.C. 20036

Counsel for AMSC

Philip L. Malet, Esquire
Alfred Mamlet, Esquire
STEPTOE & JOHNSON
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036

Counsel for Motorola Satellite Communications, Inc.

Jill Abeshouse Stern, Esquire
William R. Malone, Esquire
Eldred D. Ingraham, Esquire
MILLER & HOLBROOKE
1225 19th Street, N.W.
Suite 400
Washington, D.C. 20036

Counsel for Ellipsat Corporation

Robert A. Mazer, Esquire
Albert Shuldiner, Esquire
NIXON, HARGRAVE, DEVANS & DOYLE
One Thomas Circle
Suite 800
Washington, D.C. 20005

Counsel for Constellation Communications, Inc.

Norman P. Leventhal, Esquire
Raul R. Rodriguez, Esquire
Stephen D. Baruch, Esquire
LEVENTHAL, SENTER & LERMAN
2000 K Street, N.W.
Suite 600
Washington, D.C. 20006

Counsel for TRW



Robbin R. McKeever